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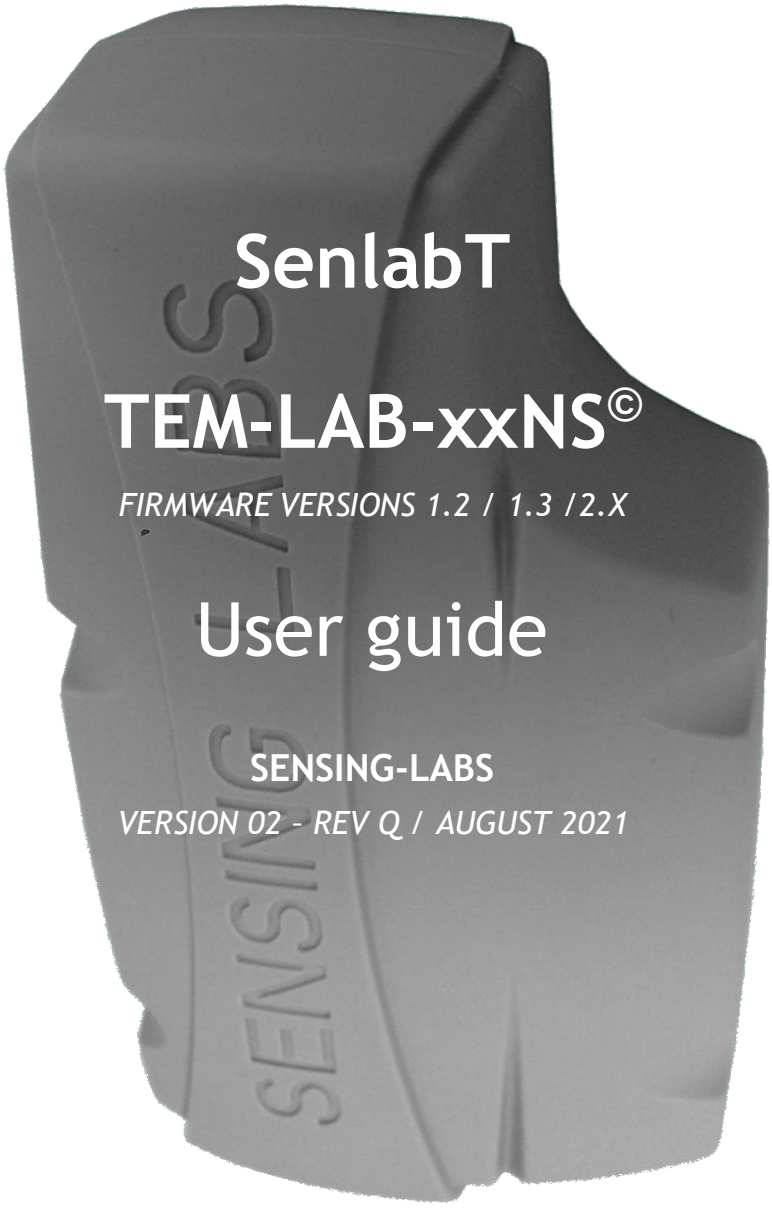

SenlabT

TEM-LAB-xxNS©

FIRMWARE VERSIONS 1.2 / 1.3 /2.X

User guide

SENSING-LABS

VERSION 02 - REV Q / AUGUST 2021

Table of contents

Thank you for your choosing our Senlab product!
We hope you will find the instructions on this user manual clear and easy to follow.

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General overview

The Senlab TEM (SenlabT) sensor is a smart LoRaWAN™ radio device with a high precision temperature sensor (see table for accuracy).


SenlabT logs the temperature and allows 2 functional modes (see Understand the two SenlabT functional modes section for more details):

- **Basic** (also called "Standard"): Periodic "log and transmit"
- **Datalog**: Periodic logs (up to 24 logs) and "all in one" transmission
- **For dual probe version, datalog** is adapted up to 12 logs per probe (temperature of probes are logged at the same time)

The indoor version is designed for office comfort monitoring, whereas, the outdoor version is made for harsh environment use.

The probe can be embedded inside the casing, on the casing or with an extension cable. It depends of the version (table below).

Advanced threshold detection is available since v2.0 (see Thresholds overrun (FW >= V2.x.x)).

Check "SenlabV2" Application Note for V2.0 full specs: network migration, re-join…

Part number	Temperature probe	Measure scale	Typical accurancy	Casing type	Protection level	Dimension
TEM-LAB-13NS	Compact	*-20°C to +70°C*	± 0.2°C	Outdoor	IP68	102x56x35mm
TEM-LAB-14NS	External 1m cable	*-45°C to +125°C*	± 0.5°C *-10°C to +85°C*	Outdoor	IP68	102x56x35mm probe: 30mm
TEM-LAB-24NS	External 2x 2m cable	*-45°C to +125°C*	± 0.5°C *-10°C to +85°C*	Outdoor	IP68	102x56x35mm probes: 30mm
TEM-LAB-34NS	1x external connector	-190°C to +600°C	depends of the probe	Outdoor	IP68	102x56x35mm many probes
TEM-LAB-41NS	Inside	*0°C to +55°C*	± 0.2°C	Indoor	IP30	91.5x50x25mm


TEM-LAB-41NS


TEM-LAB-13NS


TEM-LAB-14NS


TEM-LAB-24NS


TEM-LAB-34NS

Outdoor devices casing (IP68) must not be placed permanently underwater, occasional submersion during 1h max has been validated.
External probes & cable must be protected from aggressive environment or mechanical stress.

Take care to respect the operating temperature of the device Senlab:
Outdoor: -20°C to +70°C / Indoor 0°C to +55°C

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3 steps are required to make your SenlabT fully operational, described below:

Provisioning of the device

You have to be sure that your **Senlab device has been well commissioned** to be able to reach your LoRaWAN network.

- ✓ Contact if needed your distributor to get your Senlab configuration
- ✓ Required information for provisioning the device into your LoRa system are listed in the following table:

Don't unprovision device from your system before stopping it!
- ➢ refer application features to stop the application via RF)

	devEUI	appEUI	appKey	appSkey	NwkSkey	netId	devAddress
Case 1 : OTAA / PUBLIC Typical configuration for Network Operator based architecture	X	required	required				
Case 2 : ABP / PUBLIC Typical configuration for Private mono gateway network	X			required	required		required
Case 3 : OTAA / PUBLIC Sensing-Labs SLgateway V2 configuration (local network)	X	Optional*	Optional*				

(*) If asked when ordering, devices are already provisioned into your SLgateway. If not, you need these parameters.

- ✓ Network & Application configuration of Senlab device can be done:
  - ➢ At factory (for minimal batch of 1000 devices)
  - ➢ By your distributor (more often)
  - ➢ By yourself (if you have your own SLsetting tool)
- ➢ Please refer to parameter list described into the Application features chapter to fit to your use case and get a "Plug&Play" device.
- ➢ **All application configuration can also be dynamically adjusted Over The Air** (via downlink request)

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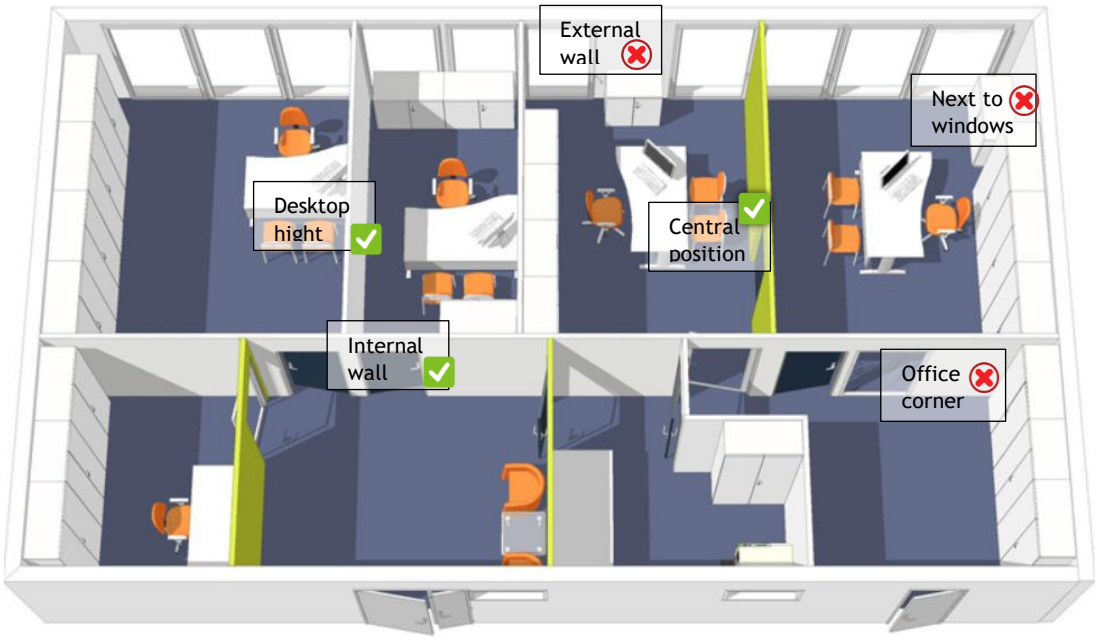
On-site installation

Indoor installation (TEM-LAB-41NS)



External probe installation (TEM-LAB-14NS & TEM-LAB-24NS)

For pipe temperature monitoring, we recommend to use a perforated hose clamp to ensure a good temperature transfer between pipe and probe.

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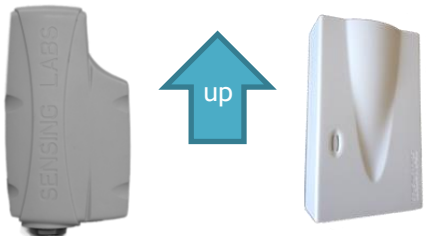
Device positioning

You have first to find the best position to your Senlab:

- ✓ Prefer vertical position (***antenna part upwards*** as on following pictures)
- ✓ Avoid positioning the external cable pulled vertically under the device (prefer coiled positioning or use the rear gutters for outdoor version)
- ✓ Avoid direct sun light exposure or heater system proximity



Device is not designed for an installation above 2 meters.

Device mounting

Device type	Device mounting
All versions	Stick the product to the wall or cabinet with a double-sided adhesive tape
Indoor versions	Screw the rear side of the product to the wall with countersunk screws make sure the screw heads don't exceed from the plastic side once installed
Outdoor versions	Use plastic cable ties with screw mount

Refer to « Application Note Senlab installation » for full recommendation.

For best radio performance:

- Positioned the upper part of the device upwardly in a free space area
- avoid positioning the Senlab against a metallic element

Now the device is well physically installed and plugged, you can start the activation process.

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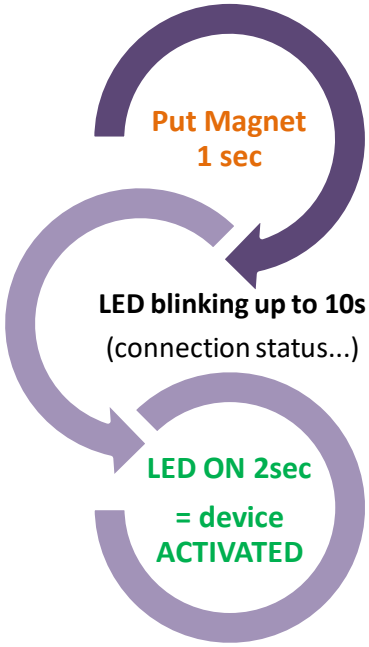
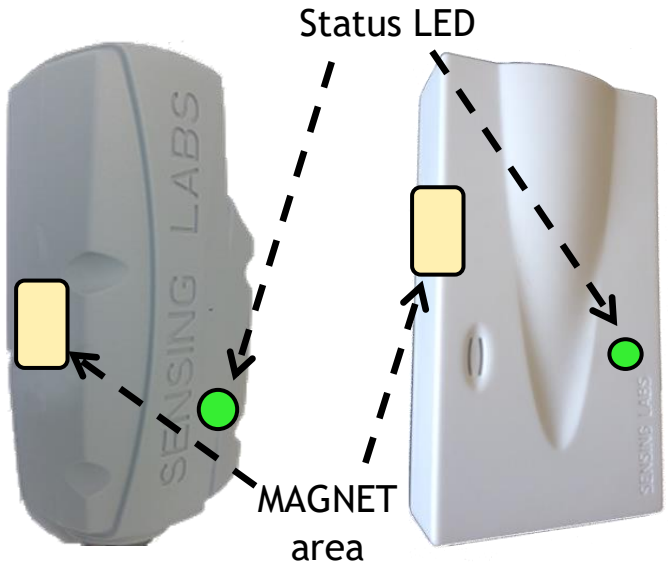
Activation of the device

To activate the Senlab device, you have to use a magnet (min pulling force 1Kg).





- ✓ Remove the magnet as soon as the LED flashes!
- ✓ If activation fails (No solid LED ON 2sec), Senlab will come back in storage mode.
- ✓ After successful activation, device will automatically send its START message

Once activated, if you pass the magnet one more time, the device will indicate its activation status after 3s LED blinking:

--> Solid LED ON 2sec will confirm that device is activated

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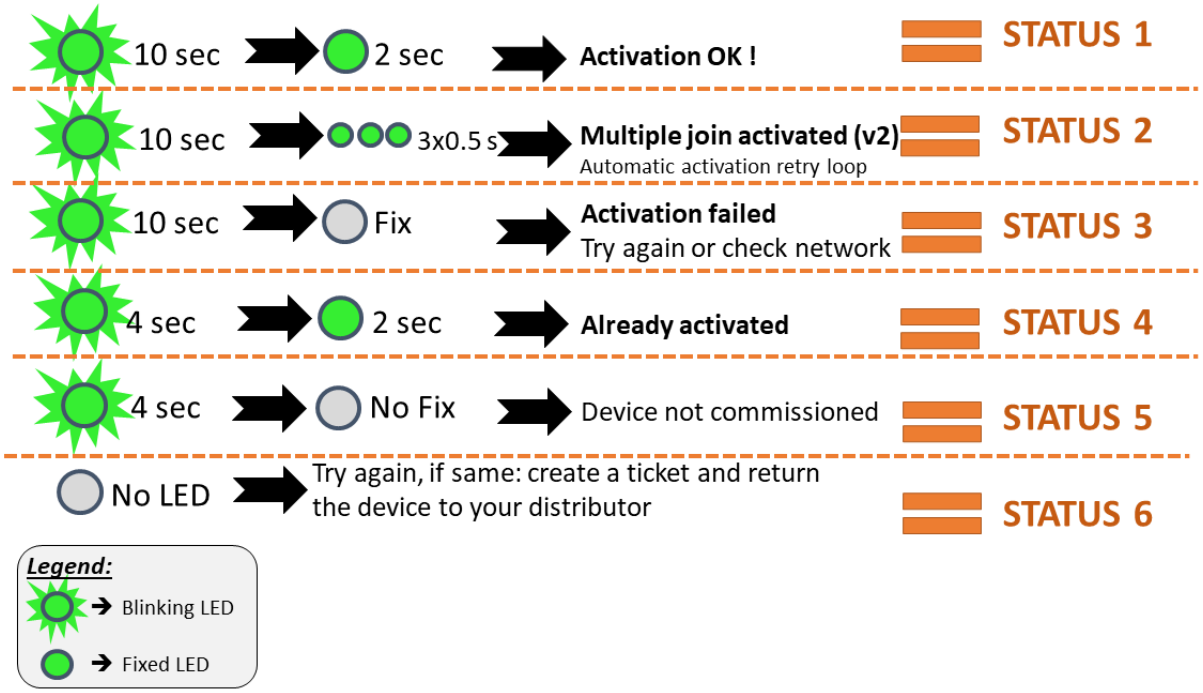
LED Status meaning



Deactivation of the device

If you decide to deactivate Senlab, no more transmissions will be sent → That means that you need a physical access to the Senlab to active it again.
Many ways are possible:

- **Over the Air**: by sending the downlink request "STOP application" (via your LoRaWAN system)
- **With physical access (with SLsetting tool)**: by using SLsetting "disconnect" action
- **With physical access (only for test devices)**: By holding the magnet during 20 seconds until the LED stay ON for 5 seconds.

Understand the two SenlabT functional modes

It is important to understand all modes in order to choose the best one to fit with your use case and environment.
All modes are switchable from one to each other Over The Air or with SLsetting tool.

Basic mode (or standard mode)

This mode allows to transmit periodically 1 measure (temperature):

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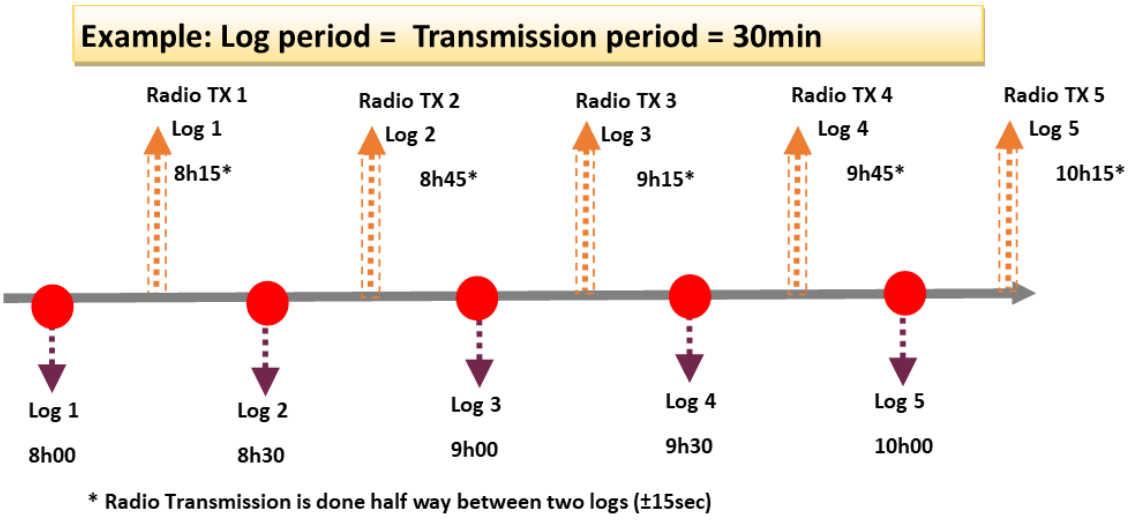
- ✓ Measure period can be configured from 3min to 24h (Tx < 10min is for test only)



Availability	**All firmware versions**
Compatibility	✓ Operated network ✓ SLgatewayV1 or V2 ✓ Third part gateway with SLcodecs or manual decoding
Advantages	✓ "Manual" decoding possible (without SLcodecs) ✓ Over The Air reconfiguration
Typical use cases	✓ Monitoring of physical value(s) with slow variation
What to configure?	✓ Measure period (the transmission period will be the same)
How to get applicative data?	✓ All SLgateway's APIs : refer to SLgateway user guide ✓ SLcodec : refer to SLcodec help ✓ By decoding payload yourself: **Refer to « Application Note SenlabMessageFormat »**

Datalog mode

This mode allows to transmit up to 24 periodic measures (temperature) in each message:

- ✓ Measure period can be configured from 1min to 24h
- ✓ Transmission period can be configured from 3min to 24h (Tx < 10min is for test only)
- ✓ Possibility to activate a "log redundancy" feature to integrate previous logs in current transmission (*ex: TX2 will contains logs n°1 to 6 and TX3 logs n°4 to 9*)

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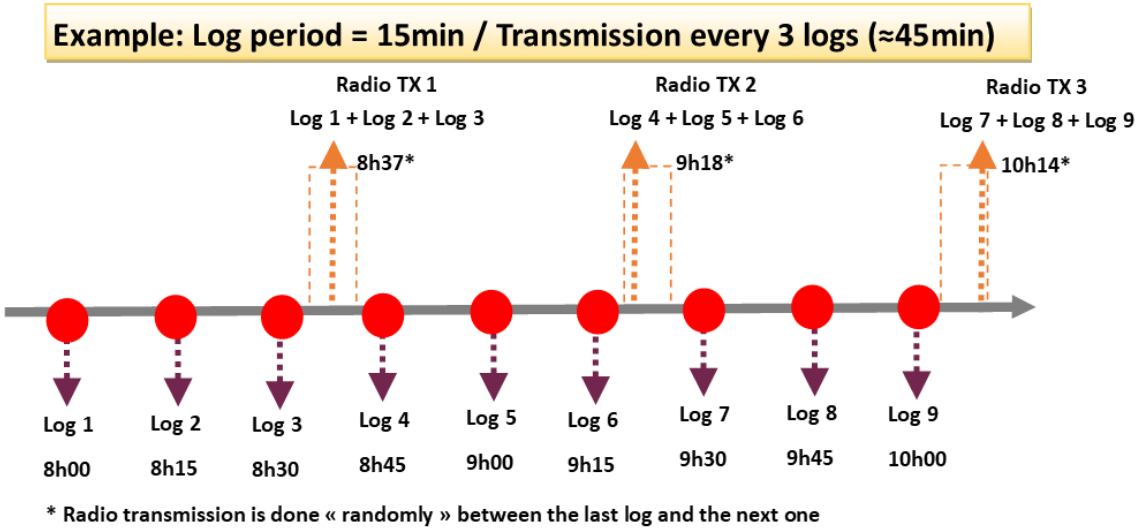

Availability	**All firmware versions**
Compatibility	Operated network SLgatewayV1 or V2 Third part gateway with SLcodecs
Advantages	Log precision up to 1 log every minute and transmission by "datalog" to optimized battery life time Log redundancy feature to recover not received message Over The Air reconfiguration
Typical use cases	Monitoring of physical value(s) with fast variation Important battery life time
What to configure?	Measure period Transmission period (multiple of measure period)
How to get applicative data?	All SLgateway's APIs : refer to SLgateway user guide SLcodec : refer to SLcodec help

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Application features (datalog mode)

This chapter describes the SenlabT application features available in datalog mode (accessible via SLgateway or SLcodec – refer respective User Guide for more details)

Measure data

ID	Description	Type	Unit	Range
temperature	Measured temperature (***blue probe*** *if dual*)	FLOAT	°C	-45...+125
temperature2	Measured temperature of ***red probe***	FLOAT	°C	-45...+125
battery_current_level	Battery level of the device	UINT8	%	1…100

Event data

ID	Description	Type	Unit	Range
start_event	Happens when device is restarted on the field	BOOL	-	-

Configuration requests

Online describe on http://codec.slbase.io/senlabT

Parameter ID	Description	Type	Unit	Range
	Datalog configuration (ID = request_write_datalog_cfg)			
log_period	Device will measure every X minutes	UINT16	Minute	1...1440 (1440= 24h)
log_tx_period	Device will send logged measure every X minutes (must be a multiple of log_period)	UINT16	Minute	3...1440
log_tx_random_activation (optional)	Maximize device datalog reliability	BOOL	-	-
redundancy_factor	Log-redundancy ***(since FW V1.3)*** Send the X n-1 last log(s) with the last log(s)	UINT8	-	1-12
	Reset battery level (ID = request_reset_battery_level) *Must be used after battery replacement only*			
NO PARAMETERS				
	Stop application (ID = request_stop_application) *Warning: activation with magnet will be mandatory to reactivate the device*			
NO PARAMETERS				
	GET VERSION *(since FW V1.3)* (ID = request_get_version) *Ask the device to return it configuration and FW version*			
NO PARAMETERS				
	SHIFT LOG *(since FW V2.0)* (ID = request_shift_log) *Ask the device to return it configuration and FW version*			
log_shift	Delta for shifting log acquisition	INT16	Seconde	-32767.. 32767

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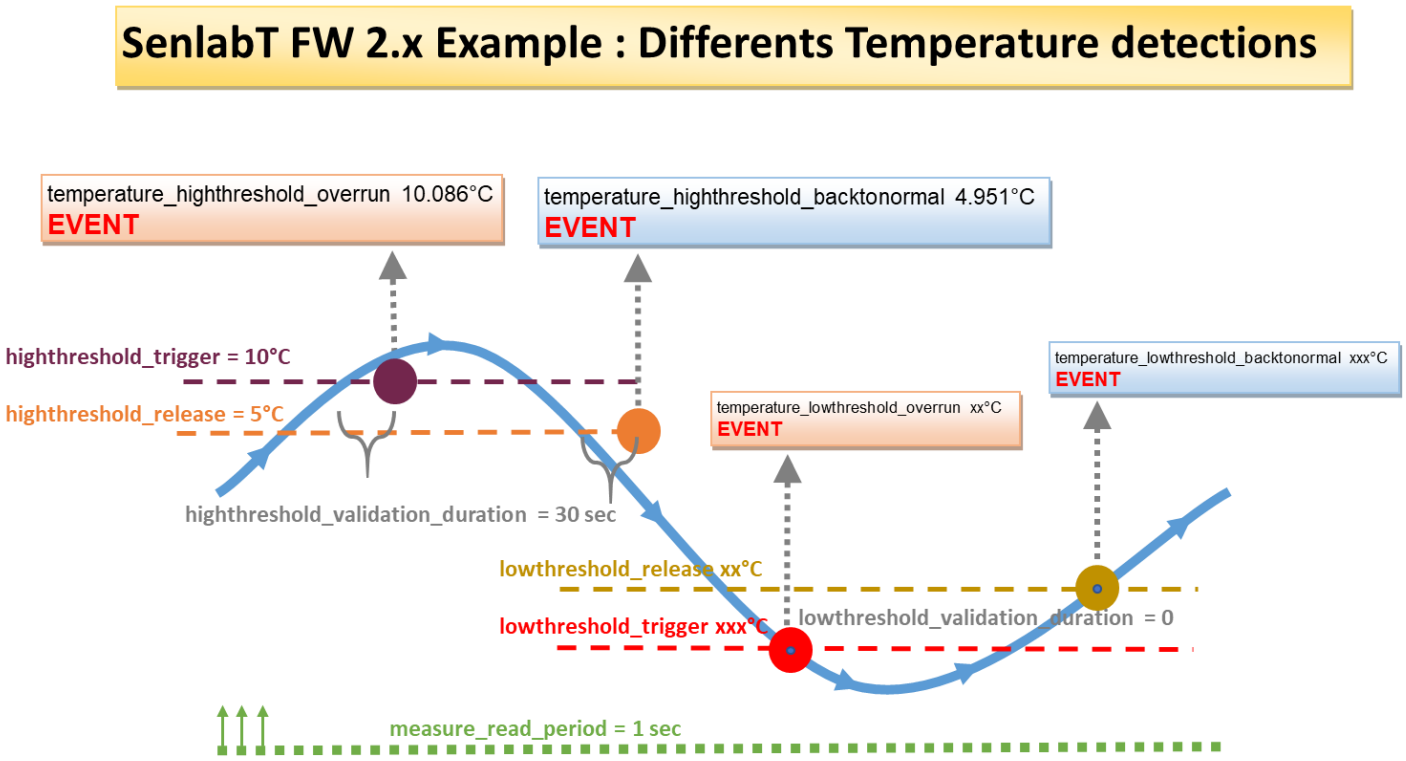
Thresholds overrun (FW >= V2.x.x)

(Refer to old User Guide for FW V1.X)

SenlabT embed a feature to monitor thresholds overrun. You can activate independently a high and a low threshold, with specific trigger & release temperature values.

- ✓ Check temperature period and duration of threshold overrun are configurable
- ✓ The temperature is transmitted in the alarm (nb of retransmission is configurable)
- ✓ Threshold overrun feature can be configured via SLsetting tool or over-the-air (downlink payload)
- ✓ If dual probes, each probe have is own threshold configuration



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Configuration requests

Online describe on http://codec.slbase.io/senlabT

Parameter ID	**Description**	**Type**	**Unit**	**Range**
	REQUEST ALARMS CONFIGURATION (ID = request_alarms_configuration)			
measure_read_period*	Temperature(s) read period for alarm detection *low value (<10sec) impacts battery life duration*	UINT16	sec	1..600
alarms_retransmissions_number*	Alarms retransmissions number	UINT8	-	0..3
temperature_highthreshold_activation**	Temperature high threshold activation	BOOL	-	
temperature_highthreshold_validation_duration	Temperature high threshold validation duration *Must be a multiple of measure_read_period*	UINT16	sec	1…65535
temperature_highthreshold_trigger	Temperature high threshold value that must be maintain the validation duration to trigger the alarm	FLOAT	°C	-47…+128
temperature_highthreshold_release	Temperature to release high threshold overrun (< to high trigger value and > to low release value)	FLOAT	°C	-47…+128
temperature_lowthreshold_activation**	Temperature high threshold activation	BOOL	-	
temperature_lowthreshold_validation_duration	Temperature high threshold validation duration *Must be a multiple of measure_read_period*	UINT16	sec	1…65535
temperature_lowthreshold_trigger	Temperature high threshold value that must be maintain the validation duration to trigger the alarm	FLOAT	°C	-47…+128
temperature_lowthreshold_release	Temperature to release high threshold overrun (< to high trigger value and > to low release value)	FLOAT	°C	-47…+128
temperature2_highthreshold_activation**	Temperature high threshold activation	BOOL	-	
temperature2_highthreshold_validation_duration	Temperature high threshold validation duration *Must be a multiple of measure_read_period*	UINT16	sec	1…65535
temperature2_highthreshold_trigger	Temperature high threshold value that must be maintain the validation duration to trigger the alarm	FLOAT	°C	-47…+128
temperature2_highthreshold_release	Temperature to release high threshold overrun (< to high trigger value and > to low release value)	FLOAT	°C	-47…+128
Temperature2_lowthreshold_activation**	Temperature low threshold activation	BOOL	-	
Temperature2_lowthreshold_validation_duration	Temperature low threshold validation duration *Must be a multiple of measure_read_period*	UINT16	sec	1…65535
Temperature2_lowthreshold_trigger	Temperature low threshold value that must be maintain the validation duration to trigger the alarm	FLOAT	°C	-47…+128
Temperature2_lowthreshold_release	Temperature to release low threshold overrun (< to high trigger value and > to low release value)	FLOAT	°C	-47…+128

(*) mandatory parameters

(**) at least 1 of the 2 alarms must be activated or deactivated (1 of the 4 alarms for TEM-LAB-24NS)

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Event data (Alarm)

ID	Description	Type	Unit	Range
temperature_highthreshold_overrun	Notified if high threshold condition is triggered (temperature & duration / blue probe for dual)	FLOAT	°C	-45...+125
temperature_highthreshold_backtonormal	Notified if high threshold condition is released (temperature & duration / blue probe for dual)	FLOAT	°C	-45...+125
temperature_lowthreshold_overrun	Notified if low threshold condition is triggered (temperature & duration / blue probe for dual)	FLOAT	°C	-45...+125
temperature_lowthreshold_backtonormal	Notified if low threshold condition is released (temperature & duration / blue probe for dual)	FLOAT	°C	-45...+125
	Next events are available only for TEM-LAB-24NS version (Dual probe)			
temperature2_highthreshold_overrun	Notified if high threshold condition is triggered for the red 2nd probe (temperature & duration)	FLOAT	°C	-45...+125
temperature2_highthreshold_backtonormal	Notified if high threshold condition is released for the red 2nd probe (temperature & duration)	FLOAT	°C	-45...+125
temperature2_lowthreshold_overrun	Notified if low threshold condition is triggered for the red 2nd probe (temperature & duration)	FLOAT	°C	-45...+125
temperature2_lowthreshold_backtonormal	Notified if low threshold condition is released for the red 2nd probe (temperature & duration)	FLOAT	°C	-45...+125

Battery replacement (Indoor version only)

Replacement battery must by a Lithium 3,6V AA type with 50mA min of supported continuous current → Contact your distributor to get original battery reference.

Senlab indoor have the capability to keep activation status during a few minutes, so the process is:

1. Open the casing
2. Remove the old battery and, **during the same minute**, put the new battery
3. Check if the device activation is still OK (see "Activation of the device" chapter)
4. In case activation lost, you need to activate the device again
5. Close the casing
1. Send the configuration request "request_reset_battery_level" to the device, using your application

ATTENTION:

EN: There is a risk of explosion if the battery is replaced by an incorrect type. Dispose of used batteries according to instructions.
FR: Il y a risque d'explosion si la batterie est remplacée par une batterie de type incorrect. Mettre au rebut les batteries usagées conformément aux instructions.

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Technical characteristics

ISM Radio bands usage

Senlab globally communicates over frequencies in the 865-870MHz radio band with a maximum transmission power of 25mW e.r.p (+14dBm e.r.p).

More precisely, the following table describes the different sub-bands, as defined per Annex 1 of ERC Recommendation 70-03 (13 October 2017), which can be used by Senlab:

Frequency Band		Power	Spectrum Access
h1.3	865-868MHz	25mW e.r.p	1% duty-cycle
h1.4	868-868.6MHz	25mW e.r.p	1% duty-cycle

Note that 1% duty-cycle for sub-band h1.3 is allowed by ERC/REC 70-03 Annex 1 Note 5 as its usage is limited to 865-868MHz.

V1.0.3 LoRaWan stack compliant

Senlab FW	LoRaWan stack compliant
1.1.X	V1.0.0
1.2.X / 1.3.X / 1.4.X	V1.0.1
2.0.X	V1.0.3

Nothing to configure for the user, no change for the application layer, but this information could be useful if you need to connect Senlab device to LoRaWan network.

More information on LoRa Alliance®

LoRaWan Adaptive Data Rate (ADR)

Senlab devices are compatible with ADR and support from DR0 (SF12) to DR5 (SF7).
For any problem with ADR, check the FAQ Senlab on Help Center.

Electrical safety

All circuits are SELV (Safety extra low voltage), including interface circuits which are only used for measurement (signals without power, these circuits are considered LPS).

Ambient temperature of use

The ambient temperature of use depends of the version:

Indoor version	From 0°C to +55°C
Outdoor version	From -20°C to +70°C

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